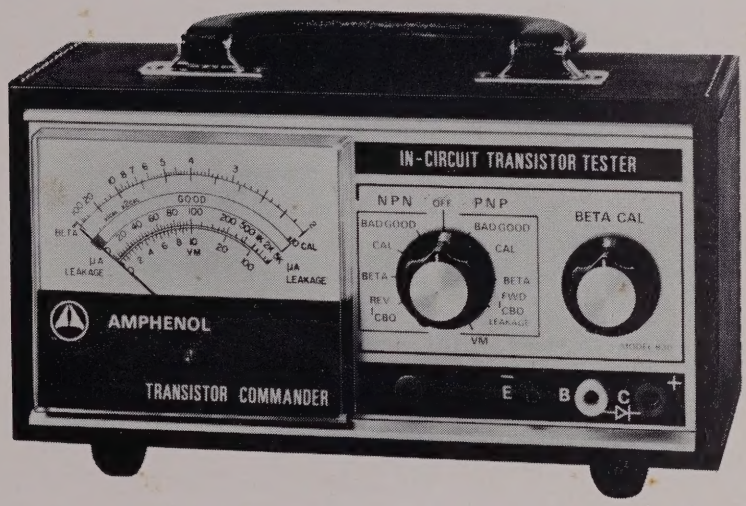
AMPHENOL

TM

OPERATING SERVICE MANUAL



IN CIRCUIT TRANSISTOR TESTER

MODEL 830

TRANSISTOR COMMANDER

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Motorola HEP Series Replacement Number	General Electric GE Series Replacement Number	RCA SK Series Replacement Number
HEP-3	GE-9	SK-3006
HEP-3	GE-9	SK-3007
HEP-232	GE-3	SK-3009
HEP-54/725	GE-10	SK-3019
HEP-55/724	GE-10	SK-3020
HEP-2	GE-1	SK-3005
HEP-230	GE-3	SK-3009
HEP-801	GE-FET-1	—
HEP-253	GE-1	SK-3004
HEP-641	GE-5	SK-3011

io

Technician, Experimenter, and Hobbyist with a readily available source of

AMPHENOL WARRANTY

Amphenol warrants equipment manufactured by it to be free from defects in material or workmanship, and agrees to repair or replace such equipment which in normal service develops faults attributable to the manufacturer. Faulty equipment must be returned, transportation prepaid, within 90 days from purchase date in the original or an equally suitable cushioned shipping carton. The attached warranty card should be filled-in and mailed within 10 days of purchase to register the equipment and owner. This warranty shall be void in any instance where, in our opinion, the equipment (1) has been altered, modified or tampered with not in accordance with our written instructions or by other than factory approved service stations, (2) has been dropped, submerged, or suffered physical abuse or neglect beyond simple wear-and-tear, or (3) has the identification or serial numbers altered, defaced or obliterated. Accessory devices, batteries, crystals and attachments not made by Amphenol are not covered by this warranty and their attachment to this equipment is solely at the users risk. This warranty is in lieu of all other warranties expressed or implied and no one is authorized to assume for Amphenol any other or additional liability beyond the limits stated herein.

COMMANDER

This Commander Replacement Transistor Kit contains many of the devices commonly needed in the servicing of AM and AM/FM radios, television receivers, tape recorders, and a multitude of other electronic equipment.

The correct replacement transistor for your particular application should first be determined. Consult any of a number of sources for specific replacement data. Sams Photofact, Motorola HEP Guide, and RCA SK Guide are a few of the sources which give detailed information on the replacement of common transistor types.

The correct replacement transistor for your application should first be determined. Use the following table to locate the proper Commander replacement device for your application.

Quan in Kit	Commander RP Series Replacement Number	Description	Motorola HEP Series Replacement Number	General Electric GE Series Replacement Number	RCA SK Series Replacement Number
10	2N2089	PNP Ge. Use as RF Amp Mixer or Osc. up to 150 MHz	HEP-3	GE-9	SK-3006
10	2N2092	PNP Ge. Use as RF Amp, Mixer or Osc. up to 30 MHz	HEP-3	GE-9	SK-3007
2	40050	PNP Ge. Use as Audio Output; up to 12 watts.	HEP-232	GE-3	SK-3009
3	2N2924	NPN Si. Use as RF Amp, Mixer or Osc. up to 30 MHz	HEP-54/725	GE-10	SK-3019
2	2N2712	NPN Si. Use as RF Amp, Mixer or Osc. up to 150 MHz.	HEP-55/724	GE-10	SK-3020
4	R-539	PNP Ge. Use as RF Amp, Mixer or Ocs. up to 500 MHz.	HEP-2	GE-1	SK-3005
4	2N250	PNP Ge. Use as Audio Output; up to 25 watts	HEP-230	GE-3	SK-3009
1	U-1951	N Channel FET Si. Use for low level audio or low frequency RF Amp.	HEP-801	GE-FET-1	--
2	2N1303	PNP Ge. Use as small signal audio Amp.	HEP-253	GE-1	SK-3004
2	2N1302	NPN Ge. Use as small signal Audio Amp. Complementary to 2N1303	HEP-641	GE-5	SK-3011

This group of transistors has been selected to provide the Professional Service Technician, Experimenter, and Hobbyist with a readily available source of the most needed devices for Audio and RF small signal as well as Audio power applications.

Each device in this assortment has been tested and inspected to insure compliance with the rigid Commander specifications. All devices have been manufactured by the foremost semiconductor producers: RCA, Texas Instruments, Motorola, Continental Devices, and Fairchild.

These devices have been selected to simplify the replacement of many manufacturers' special house numbers, both domestic and foreign, as well as standard JEDEC numbers. Occasionally, in very critical circuits, minor bias and/or coupling changes may be necessary in order to achieve optimum results. Also, tuned circuits should be checked for proper alignment. Circuit re-adjustment may be needed.

The specifications to which these devices are tested insure that the Hobbyist/Experimenter can safely design his own circuits and realize the maximum device capability. For the Professional Service Technician use of the Commander replacement device suggested will insure equal, or better performance of the circuit, than the original device employed.

Each Commander device will give excellent performance when operated within the specifications shown on the attached information; however, due to the very nature of a general replacement device there are certain aspects that require consideration when making substitutions. In the greatest majority of cases it will be found that direct substitution can be made, requiring no circuit or mechanical changes. Occasionally the "stubborn" circuit will appear, where other components have changed values, or the original design was extremely critical. The following tips are presented for your information in using the Commander Semiconductors in your Replacement Device Kit.

LOW POWER TRANSISTORS—Lead configuration may differ; check original and replacement devices to be sure that collector, emitter, and base lead connections are correct. In most cases, fourth lead (shield) can be cut off and eliminated. Current and voltage ratings must be checked, being certain not to exceed device ratings. Occasionally resistance values will have to be changed in order to achieve correct biasing. Tuned circuits may require circuit realignment.

HIGH POWER TRANSISTORS—Make certain voltage and current ratings are not exceeded. Adjust bias resistance to obtain optimum performance (many circuits utilize a small potentiometer for adjustment of the correct bias levels). Check all circuit components (resistors, thermistors, coils, transformers, and diodes) as damage to these components may have occurred if the original transistor was shorted. In most auto radio output stages, as well as other high level amplifiers, check emitter resistor to insure that replacement transistor will not be damaged.

SILICON RECTIFIERS—Make certain that polarity is correct and that voltage and current ratings are not exceeded. Additional current can be handled by connecting two diodes in parallel and additional peak reverse voltages can be obtained by connecting diodes in series.

REPLACING SELENIUM, METAL-OXIDE, OR VACUUM TUBE RECTIFIERS—Silicon rectifiers are much more efficient than other types of rectifiers and do not become less efficient with age; in other words they are either good or bad. Due to increased efficiency, however, it is recommended that a 10-watt resistor be placed in series with the B+ line to limit the output voltage to the required level. The correct resistance value can be determined

ZENER DIODES—Optimum zener operation will result when specified I_{ZT} is maintained during normal circuit operation. Zener diodes may be connected in series to increase zener voltage.

AMPHENOL WARRANTY

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RETURNING EQUIPMENT FOR REPAIR

When returning equipment for service, under warranty or otherwise, use the original or equally suitable cushioned shipping carton and send equipment prepaid to your nearest Amphenol Service Agency of the Amphenol Distributor Division, 2875 South 25th Avenue, Broadview, Illinois 60153. For the name of your nearest Amphenol Service Agency contact your Amphenol Distributor or Amphenol Field Sales Office.

Transportation cost on returned equipment must be prepaid by the owner. The manufacturer will pay transportation cost from the company back to the owner on equipment under warranty only. All correspondence pertaining to repairs should be addressed to the company, as above, and marked attention: Service Department.

REGISTRATION CARD

The above warranty is contingent upon the attached registration card being returned to the factory within 10 days of the date the equipment was purchased.

CONTENTS

SECTION			PAGE
I	GENERAL INFORMATION		7
	1–1	Purpose	7
	1–2	Change	7
	1–3	Specifications	7
	1–4	Safety Hints	8
	1–5	Adapters	8
II	OPERATION		9
	2–1	Operation of Controls	9
	2–2	Bad-Good Test	9
	2–3	Beta Test for Transistors (In and Out-of-Circuits)	10
	2–4	Open and Short Test for Transistors (In and Out-of-Circuit)	11
	2–5	Leakage Test For Transistors ICBO and ICEO. (Out-of-Circuit)	11
	2–6	Matching Transistors and Diodes	12
	2–7	Diode Testing (In-Circuit)	12
	2–8	Diode Testing (Out-of-Circuit)	13
	2–9	Zener Diode Testing	13
	2–10	DC Voltmeter Operation	14
	2–11	Circuit Testing Hints	14
III	CIRCUIT DESCRIPTION		
	3–1	General	16

IV MAINTENANCE

4–1 Case Removal and Calibration. 19

4–2 Repair Service 20

4–3 Parts Listed 20

4–4 Common Transistor Outlines. 22

4–5 Schematic. 24

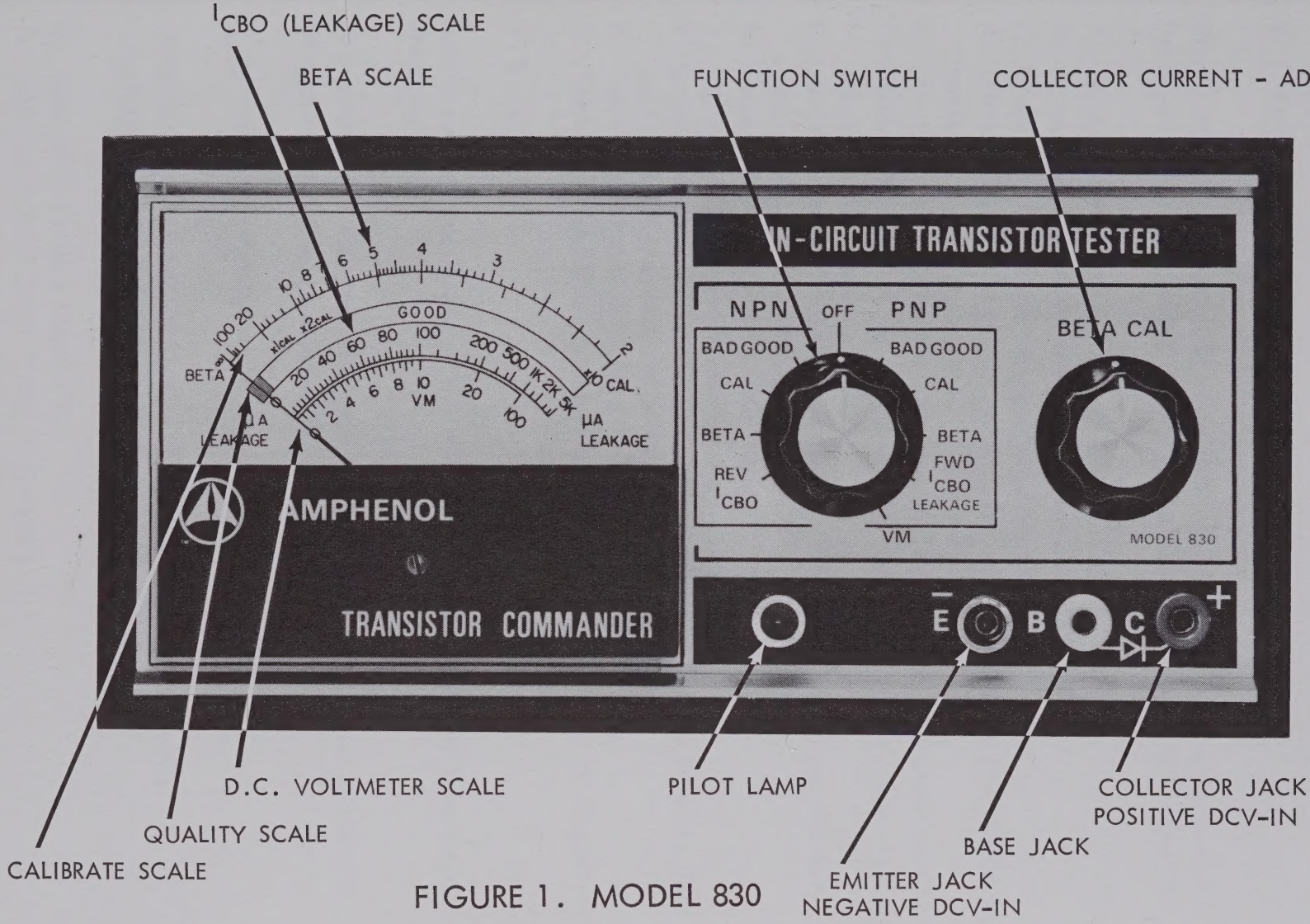


FIGURE 1. MODEL 830

SECTION I
GENERAL INFORMATION

1 - 1 PURPOSE

The Model 830 Transistor Commander is a highly accurate transistor analyzer. Below are listed a few unique features of the Model 830 Transistor Commander:

A. All solid state design.
B. Checks high and low power transistors for DC Beta in-circuit.
C. Checks ICBO and ICEO leakage, out-of-circuit.
D. Checks diodes and rectifiers in-circuit for open or shorts and their ability to rectify.
E. Checks diodes and rectifiers out-of-circuit for Forward and Reverse current.
F. Current limiting circuit for protection against accidental burn out of transistors and diodes.
G. Automatic power protection circuit so that shorted transistors and diodes cannot burn out your 830 tester.
H. Color coded meter scales for rapid testing.
I. DC voltmeter for use in measuring supply voltages.
J. Output test jacks are so arranged that a quick test socket can be adapted for rapid testing of transistors or diodes. (Listed under adapters).
K. Cabinet arranged with tilt leg for adjusting meter to eye level.
L. Features a Good-Bad quality test for production testing of transistors.

1 - 2 CHANGES

At the time of publication of this manual no modifications had been made to the equipment.

A supplement or change sheet may be included with this manual to reflect any changes required during the life of the equipment.

1 - 3 SPECIFICATIONS

POWER REQUIREMENTS - 105 - 125 VAC, 50 to 60 Hz @ 3 watts.
TRANSISTOR TESTING

A. Beta (hFE) Range 1 - 1000 ± 5%.
B. Collector Current (Ic) 0-10 MA (Adjustable).
C. Collector Base Leakage (ICBO) 0-5000 μa.
D. Collector Emitter leakage (ICEO) 0-5000 μa.
E. Quality test for transistors.

DIODE TESTING

A. In-circuit check for open or shorted diodes.
B. Out-of-circuit tests for Forward to Reverse current ratio.
C. 10 MA limit to protect diodes from accidental damage.
D. Function switch allows Forward to Reverse current measurements without removing diode from tester.

VOLTMETER

A. 0-100 DC voltage measurements can be made.
B. Has high impedance input of 100 K.

METER SCALES - 4 DIFFERENT SCALES

A. Beta (2-100).
B. Beta Cal (Ic).
C. Leakage Current (ICBO & ICEO) (blue in color).
D. DC voltmeter 0-to-100 volts (red in color).
E. Quality scale (red + green in color).

OVERALL SIZE AND WEIGHT: 9 1/4 x 5 3/4 x 6 3/8 - 3 lbs.

1 - 4 SAFETY HINTS

Before attempting to test a diode or transistor in-circuit, the operator should follow these safety points:

1. Disconnect power lines running to the equipment to be tested.
2. Shut off all power switches and remove all batteries.
3. Remember that filter capacitors may store a charge large enough to be hazardous. Discharge filters before attempting to attach leads from tester.
4. If it is impossible to remove the power lines to the equipment. Remove line fuses and open breakers in all supply circuits.
5. Above all, remember harmful voltage can appear at unexpected points.

1 - 5 ADAPTERS

The Model 830 transistor tester can be used with the following adapters:

1. Pomona Type 1472 (For Transistors).
2. Gray-Hill Type 2-2 (For Diodes).

SECTION II
OPERATION

2 - 1 OPERATION OF CONTROLS

The user should become familiar with the controls and operating features of the Model 830 Transistor Commander before attempting to put it into operation.

The front panel controls and banana jacks are illustrated in figure 1.

The function of the controls and banana jacks are as follows:

A. Function selector selects the following:
   NPN Types
   1. Bad-Good Test - for fast testing the quality of NPN transistors.
   2. Beta Cal - For calibration of collector current for DC Beta Test.
   3. Beta Test - For measuring DC Beta of NPN transistors.
   4. ICBO Test - For measuring leakage current between collector and base for an NPN transistor. (Also used for testing reverse current of diodes).

   PNP Types
   1. Bad-Good Test - For fast testing the quality of PNP transistors.
   2. Beta Cal - For calibration of collector current for DC Beta Test.
   3. Beta Test - For measuring DC Beta of PNP transistors.
   4. ICBO Leakage Test - For measuring leakage currents between collector and base for PNP transistors. (Also used for testing forward currents of diodes).
   5. V.M. Test - Used for measuring DC supply voltages up to 100 VDC.

B. OFF/ON POWER SWITCH CONTROL
   The off and on power switch is incorporated into the Rotary function switch. OFF position lies directly between NPN and PNP functions.

C. BETA CAL CONTROL - is used to calibrate collector current.

D. OUTPUT JACKS - Three output jacks are used on the Model 830. They are conveniently marked: (E) for Emitter Jack
   (B) for Base Jack
   (C) for Collector Jack
   There is also a pictorial imprint of a diode shown between (B) and (C) jacks for correct polarity hookup of diodes.

2 - 2 BAD-GOOD TEST

A fast simple means of transistor troubleshooting is provided by this test.

Simply connect the test leads to the transistor in the circuit under test. Switch to BAD-GOOD under N-P-N and then switch to BAD-GOOD under P-N-P. The meter will indicate in the green for one of these positions telling that the transistor is good and will also determine it's polarity.

If there is a red indication for both positions, then the BETA test should be performed before judging the transistor bad.

2 - 3 BETA TEST FOR TRANSISTORS (In and Out-of-Circuit)

Beta is the ratio of collector current to the by base current, while keeping the collector voltage constant.

$$\frac{IC}{IB} = hFE$$

1. A. Before connecting the Model 830 for in-circuit testing, turn off supply voltages on equipment under test.
   B. Connect the E, B, and C test leads to the transistor to be tested.
   C. If you are in doubt about lead identification of the transistor consult a transistor specification manual such as Howard W. Sams transistor Manual.

2. A. Select either the NPN or PNP function, whichever matches the type of transistor to be tested. (If type unknown see Step 2C).
   B. The left hand side of the Model 830's front panel is marked NPN which is used when testing NPN transistors. The right hand side of the panel is marked PNP which is used when testing PNP transistors.
   C. If you are in doubt to what type the transistor is, you may quickly find this out by turning the function knob to the CAL Beta position under NPN. Turn the BETA CAL control clockwise for about 3/4 of a turn. If the pointer of the meter swings to the left and off scale, the transistor is a PNP type. If the meter swings to the right and upscale the transistor is an NPN type.

3. After the type of transistor is determined (NPN or PNP, set the function switch pointer knob to CAL Beta under the desired type selected.

4. A. You are now ready to calibrate the collector current. This is done by adjusting the BETA CAL control so that the meter pointer points directly to X10 mark (full scale reading).
   B. Turn the function switch pointer knob to BETA position and read the Beta.

C. Multiply your Beta Indication by 10, (your multiplier in CAL Beta position). The end result will equal the Beta.
EXAMPLE: A Beta indication of 5 x 10 = Beta of 50.

D. To test transistors with a Beta lower than 20. Set the function switch back to CAL Beta position and adjust the BETA CAL control so that the meter reads XI. Switch the function switch to the Beta position and read the Beta directly from the Beta scale.

5. The Model 830 has ten calibrated marks any of which can be used to calculate the Beta of a transistor. Each mark from 1 to 10 indicates an increase of collector current of 1 MA. If you wish to test a transistor at a particular collector current up to a maximum of 10 MA, then adjustment of the desired collector current is done curing Step 4 A.

2 - 4 OPEN AND SHORT TEST FOR TRANSISTORS (In and Out-of-Circuit)

Open or shorted transistors will be easily spotted when your Model 830 tester is used during Beta test (2-3). The first condition noticed is that you will not be able to calibrate the Model 830, or if it calibrates, the meter will show no up scale indication when switched to the Beta position. The above conditions prevail when a transistor is open and shorted.

2 - 5 LEAKAGE TEST FOR TRANSISTORS (ICBO and ICEO) Out-of-Circuit

Testing for ICBO and ICEO MUST be done out-of-circuit to prevent circuit components from affecting the readings.

ICBO TEST

1. Connect the red clip lead to the Collector of the transistor, connect the yellow clip lead to the Base of the transistor, and connect the black clip lead to the emitter of the transistor under test.

2. Set the function selector knob to ICBO position under either NPN or PNP whichever function matches the type of transitor under test.

3. Read the leakage directly from the blue leakage scale.

ICEO TESTING

When ICBO is too small to indicate on the meter, an ICEO test may provide an usuable indication.

The leakage current in the base circuit (ICBO) will be amplified in the Emitter circuit in the same manner that an external signal current is amplified. Therefore

the collector-base leakage current (ICBO) multiplied by Beta equals the Emitter current (ICEO).

$$ICBO \times (BETA + 1) = ICEO$$

EXAMPLE: The transistor under test has a measured beta of 100. The ICBO test indicates zero. Checking ICEO, the indication is 8 μa.

$$\frac{ICEO}{BETA + 1} = ICBO \qquad \frac{8}{100 + 1} = .08\ \mu a$$

From this we can determine that ICBO is .08 μa.

ICEO TEST

1. Connect the red clip lead to the collector of the transistor, connect the YELLOW clip lead to the EMITTER of the transistor and the black clip lead to the Base of the transistor.

2. Set the function selector knob to ICBO position under either NPN or PNP whichever function matches the type of transistor under test.

3. Read the leakage directly from the blue leakage scale.

2 - 6 MATCHING TRANSISTORS AND DIODES

To match transistors and diodes pick transistors and diodes for identical beta and leakage readings. (See Beta test, leakage test, diode testing), the closer the readings of paired transistors, the better the "match".

2 - 7 DIODE TESTING (IN-CIRCUIT)

A. Before connecting the Model 830 for In-Circuit diode test, turn off supply voltages of equipment under test.

B. Connect the (C) RED test lead to the negative end or arrow (→) of the diode. (IF POLARITY IS UNKNOWN CONNECT TO EITHER END OF DIODE).

C. Connect the (E) BLACK test lead to the positive end of the Bar (|——) of the diode. (IF POLARITY IS UNKNOWN CONNECT TO EITHER END OF THE DIODE).

D. Set the function switch to CAL Beta (PNP side).

E. Rotate BETA CAL control 3/4 turn clockwise.

F. If the Diode is good the meter will rise into the green zone. If the diode is good but polarity is reversed the meter will indicate down-scale.

G. It should be remembered that if the diode under test is in a very low impedance circuit then the diode may appear defective. If this effect is noted, disconnect the diode from the circuit by clipping one of its leads and repeat steps D, E, F, or test as per (diode testing out-of-circuit [2-8]).

2 - 8 DIODE TESTING (OUT-OF-CIRCUIT)

A. Connect the (C) RED test lead to the positive end or Bar (⊢) side of the diode.

B. Connect the (B) YELLOW test lead to the negative end or Arrow (→) side of the diode.

C. Set the function switch to FWD (PNP side). If the diode is good it should conduct current. Read the current flowing in the forward position - this is read directly from the 0-5000 ua leakage scale.

D. Turn the function switch to REV position and note the reading on the leakage scale.

E. You have now taken the two readings necessary to determine the Forward and Reverse current ratio of the diode.

2 - 9 ZENER DIODE TESTING

Zener diodes are silicon rectifiers on which the reverse current remains small until the breakdown voltage is reached. Then the current increases rapidly with little increase in voltage. By using the three rules given below, the majority of zener diodes can be tested. (Zener diodes can also be tested under 2 - 6 Diode test).

NOTE: Connect the red (C) clip lead to the negative end of the diode, connect the yellow (B) clip lead to the positive end of the diode.

1. Zener diodes ABOVE 9 VOLTS should read greater than 50% of full scale when function switch is set to the FWD position. And a reading of less than 50% of full scale when function switch is set to REV position.

2. Zener diodes BELOW 9 VOLTS should read greater than 50% of full scale when function switch is set to FWD position. A reading may or may not be indicated when function switch is set to REV.(But reverse current will be less than FWD.

3. A. SHORTED ZENER DIODES should read nearly full scale in both FWD and REV positions.

3. B. OPEN ZENER DIODES should read zero in both FWD and REV positions.

2 - 10 DC VOLTMETER

In order to measure DC voltages from 0-100, simply connect the RED clip lead to the positive or + side of the voltage being measured, and connect the black clip lead to the negative or – side of the voltage being measured. The voltage is then read directly from the VM scale.

2 - 11 CIRCUIT TESTING HINTS

1. Small hand held transistor radios sometimes have the volume controls connected so as to make the audio input transistor appear shorted. However, moving the volume control to the center of the volume control range will correct this situation.

2. In a case where a transistor is soldered flush to the Printed Circuit Board and where attaching the Model 830's test leads becomes impractical, it may be necessary to solder three small wires to the printed circuit lands on the bottom of the Printed Circuit Board and use these wires for connecting test clips.

3. In tracing down the transistor leads on a printed circuit board it may be helpful to place the printed circuit board over a lamp so that the light shining through the board makes the printed circuits lands identifiable from the top side of the board.

4. While testing a transistor in-circuit it is always important to view the interconnecting components located near the transistor to be tested. Always, be alert for such things as solder shorts, broken leads, burned components, etc.

5. While testing audio output transistors it would be advisable to first check the circuit for burned resistors. Emitter resistors are a common failure when an audio output transistor shorts out.

6. In power supplies open and/or shorted diodes sometime attribute to a filter capacitor failure.

7. In some radios a weak output from the detector diode could be attributed to an open AVC diode or an open or weak R.F. transistor.

8. Many problems of hand held radios can be attributed to the batteries. A quick check by using the Model 830's voltmeter can determine if the batteries are at fault. (This test should be conducted while the radios off/on control is in the ON position).

9. When using your Model 830 tester for checking transistors in-circuit on solid state TV sets, you may have to remove from the circuit those transistors in the horizontal and vertical deflection circuits. This condition exists due to very low impedances in the deflection circuits.

10. When an in-circuit reading becomes difficult to obtain, a close review of the interconnecting points of the transistor under test should be taken. It sometimes will be found that another transistor is connected in series with transistor under test. Or that a diode may be connected into the circuit, somewhere between two of the transistors legs.

11. It is also a worthy note to remember that equipment having solid state design is normally designed in such a way as to be fairly burnout-proof. This is to say whenever a transistor or diode does burn out, there is a distinct reason. In a great many cases there is a defective interconnecting part, which is the cause of the diode or transistor failure. Keeping this in mind when you have located a defected diode or transistor, a close check of surrounding components should be made before replacing the defective diode or transistor.

SECTION III
CIRCUIT DESCRIPTION

3 - 1 GENERAL
IN-CIRCUIT and OUT-OF CIRCUIT BETA TEST

The Model 830 measures DC Beta of a transistor by applying a pulsating signal between the collector and emitter also between the base and emitter. The ratio of average collector current to average base current as the transistor conducts current is a measure of the current gain of the transistor and is termed the Beta Factor of the transistor, or simply beta. The amount of current used in the beta test is adjustable from 0 - up to - 10 millamperes, by using the BETA CAL control R2. The collector current is set to the desired amount during the CAL Beta Test position where full scale of X10 is equal to 10 millamperes of current, if a collector current of less than 10 millamperes is needed the meter is adjusted to that desired level.

When the function switch is set to BETA test, the meter is switched into the base circuit to read the average flow of base current. The Beta reading scale is calibrated as to indicate readings in terms of Beta rather than current. This enables the operator to obtain an accurate beta measurement of a transistor by multiplying the beta reading, by the amount of current that the collector was set to, in CAL hFE test position.

A Simplified diagram of the DC beta circuit is shown below:

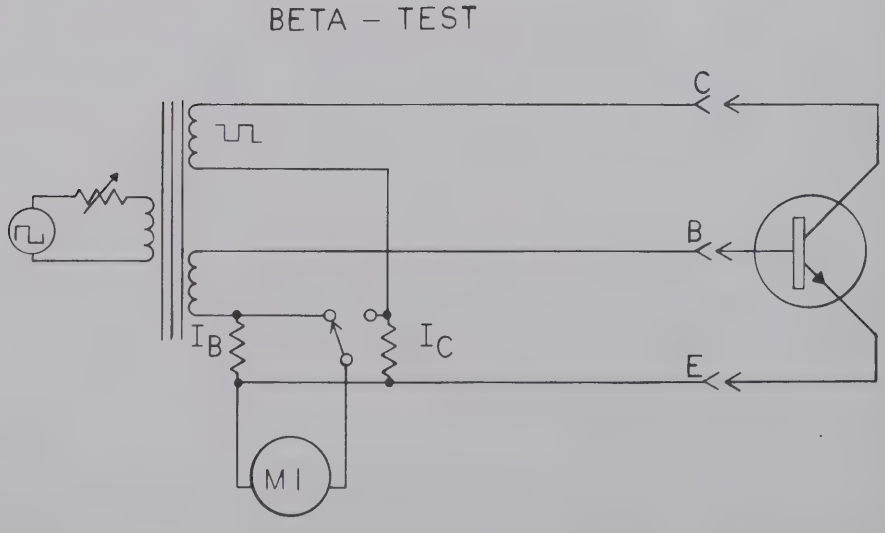


FIG - 2

ICBO Measuring Circuit

ICBO is the current flow, or leakage, from the collector to the base with the emitter open.

The voltage applied between the collector and base of the transistor is 6 to 9 VDC. The meter is connected into the Base circuit. Collector-to-base leakage is indicated directly in microamperes on the 0-5K microampere leakage scale .

A simplified diagram of the ICBO Test

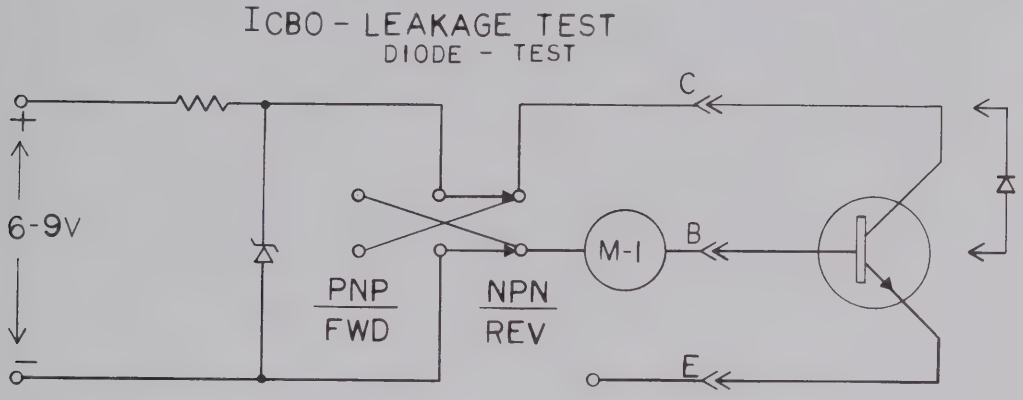


FIG - 3

ICEO Measuring Circuit

ICEO is the measurement of the leakage current flowing from the collector to the emitter, with base open. A voltage of 6-to 9VDC is applied between the collector and emitter of the transistor, the meter is connected into the Emitter circuit. The leakage current is read directly from the leakage scale.

Remember that the reading obtained is the product of the collector to base current multiplied by the gain of the transistor.

$$ICEO = ICBO \times (Beta + 1)$$

A simplified diagram is shown below:

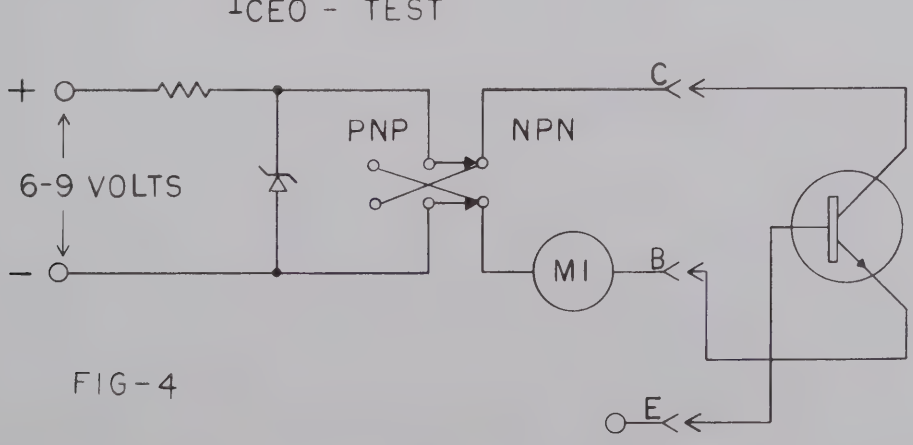


FIG-4

Transistor Quality Test (Bad-Good Test)

The quality test of transistors is the ability of the transistor to function as an oscillator. This test circuit uses a low frequency Hartley oscillator which has a link coupled detector circuit in which the meter is connected. A simplified diagram is shown below:

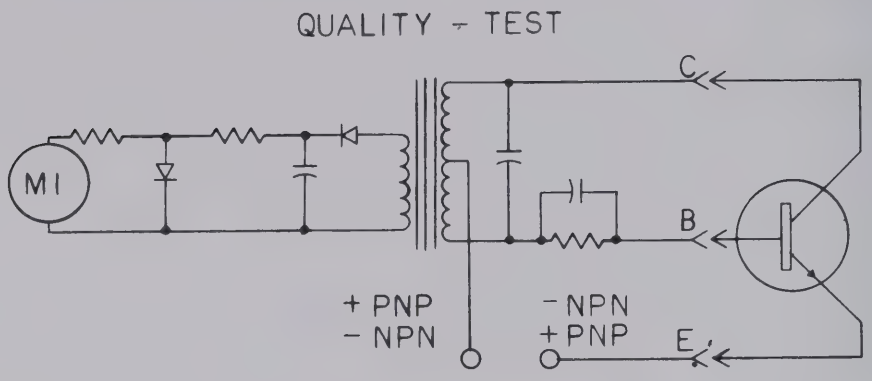


FIG - 5

DC Voltmeter Measuring Circuit

The Model 830 uses two panel jacks for inputs for measuring voltage up to 100VDC. The red or collector jack is marked (+) for the positive voltage input. The black or emitter jack is marked (–) for the negative voltage input.

A simplified circuit is shown below:

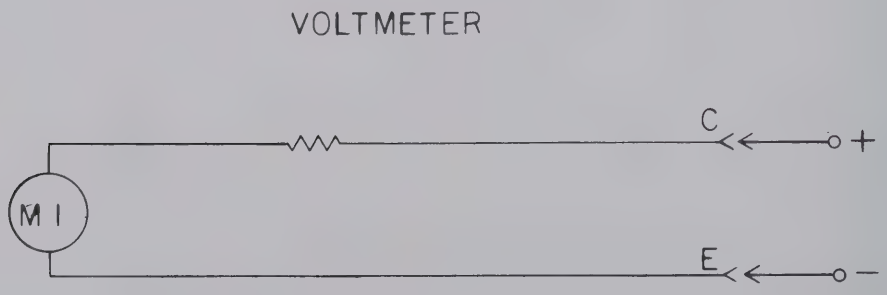


FIG - 6

SECTION IV
MAINTENANCE

4 - 1 CASE REMOVAL AND CALIBRATION

The outer case can be removed from the tester by removing four (4) screws on the back of the Model 830.

The one calibration point of the Model 830 is the calibration of R1 which is in line with the meter during the ICBO test. A test circuit and procedure shown below will show the correct method to use when calibrating the Model 830.

Equipment Needed

1. A 0-5 milliampere meter such as a Simpson 269.

2. A 2K variable resistor at about 1/2 watt.

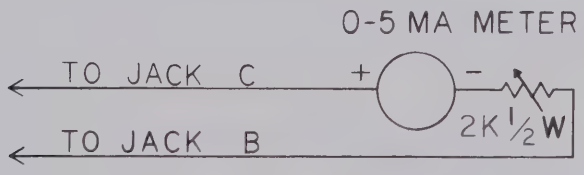


FIG -7

Calibration Procedure

1. Connect a 2K resistor in series with the negative lead of a 0-5 milliampere meter such as a Simpson 269 or equivalent.

2. Connect the Model 830 tester clip leads as shown in the diagram above, (Yellow base lead goes to one side of 2K variable resistor. Red collector lead goes to the positive side of the milliameter).

3. Set the Model 830 function switch to ICBO test under NPN.

4. Adjust the 2K variable resistor in series with the 0-5 milliampere meter so that a reading of 5 milliamperes is shown on the outside standard meter.

5. Locate the calibration resistor which is mounted on the function switch of the Model 830. R1.

6. Rotate this control until the Model 830 meter reads full scale.

7. After adjustments are made the calibration control should be locked by using bees wax or an RTV silicon rubber. This will insure against miscalibration of the control by vibration.

4 - 2 REPAIR SERVICE

Inoperative Equipment

If the tester is inoperative in any function, refer to the circuit description and the schematic diagram.

Suggested Checks

1. Check switch contacts for continuity.

2. Check resistor values with ohm meter.

3. Check voltage points shown on schematic.

4 - 3 PARTS LIST

Designation	Description	Qty.	Part No.
M1	Meter 0-200 μa	1	C390009
SW1	Function Switch, 10 pole, 12 pos.	1	B460042
DS1	Pilot Lamp	1	330007
	Line Cord	1	B060010
T1	Power & Signal Transformer	1	B530022
C1, C2	Capacitor 300 uf @ 3V	2	090034
R1	Variable Resistor 2K	1	120018
R2	Variable Resistor 10K	1	A120042
C3	Capacitor .02 uf @ 50V	1	080138
R3	Resistor 5K 10% (5 Watt)	1	140012
Q1, Q2, Q3	Transistor 2N2926	3	480020
CR1, CR2 CR3	Diode DHD805	3	280017
R4	Resistor 2.7K ½ W 10%	1	1003-272
R5	Resistor 100K ¼ W 5%	1	1001-104
R6	Resistor 220 ohms ¼ W 10%	1	1003-221
R7	Resistor 9.09 ohms ½ W ± 1%	1	1011-9R09
R8	Resistor 9.31 ohms ½ W± 1%	1	1011-9R31

R9	Resistor 56.2 ohms ½ ± 1%	1	1011-56R2
R10	Resistor 3.6K ½ W 10%	1	1003-362
R11	Resistor 100K ½ W 10%	1	1003-104
R12	Resistor 10 ohms ½ W 10%	1	1003-100
R13	Resistor 10 ohms ½ W 10%	1	1003-100
R14	Resistor 1K ½ W 10%	1	1003-102
R15	Resistor 90.9 ohms ½ W 1%	1	1011-90R9
C7	Capacitor 100 uf @ 15V	1	090019
C4, C5, C6	Capacitor .47 uf @ 75V ± 10%	3	080059
CR4	Diode SG1198	2	280004
T2	Transformer	1	B530003
C8	Capacitor 1500 uf @ 3V	1	090035

Returning the Model 830 For Repairs

If you are unable to repair your Model 830 or would like the factory service to repair it for you then follow the shipping instructions below:

1. Package the Model 830 carefully, double pack if possible.

2. A full description of the troubles should be included.

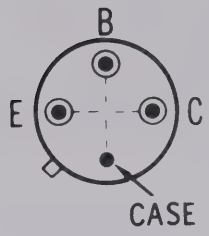
3. All test leads used with the Model 830 should be returned.

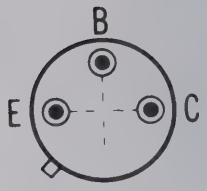
4. Insurance on the package is your protection in case of postal damage or loss of package in transit.

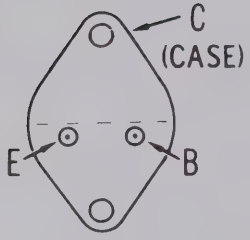
5. The following address is to be used for returning your equipment for repairs.

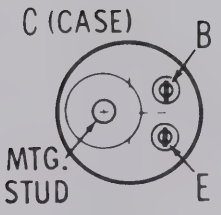
Amphenol Distributor Division
2875 South 25th Avenue
Broadview, Illinois 60153
Attention: Service Department

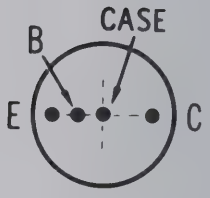
4-4 COMMON TRANSISTOR OUTLINES

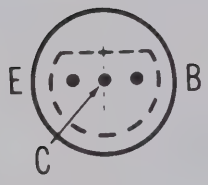


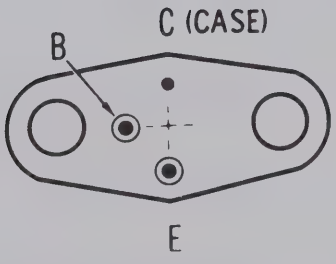


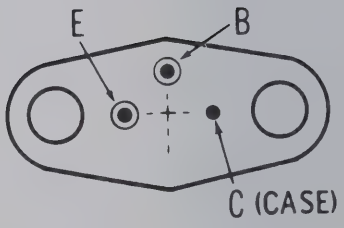


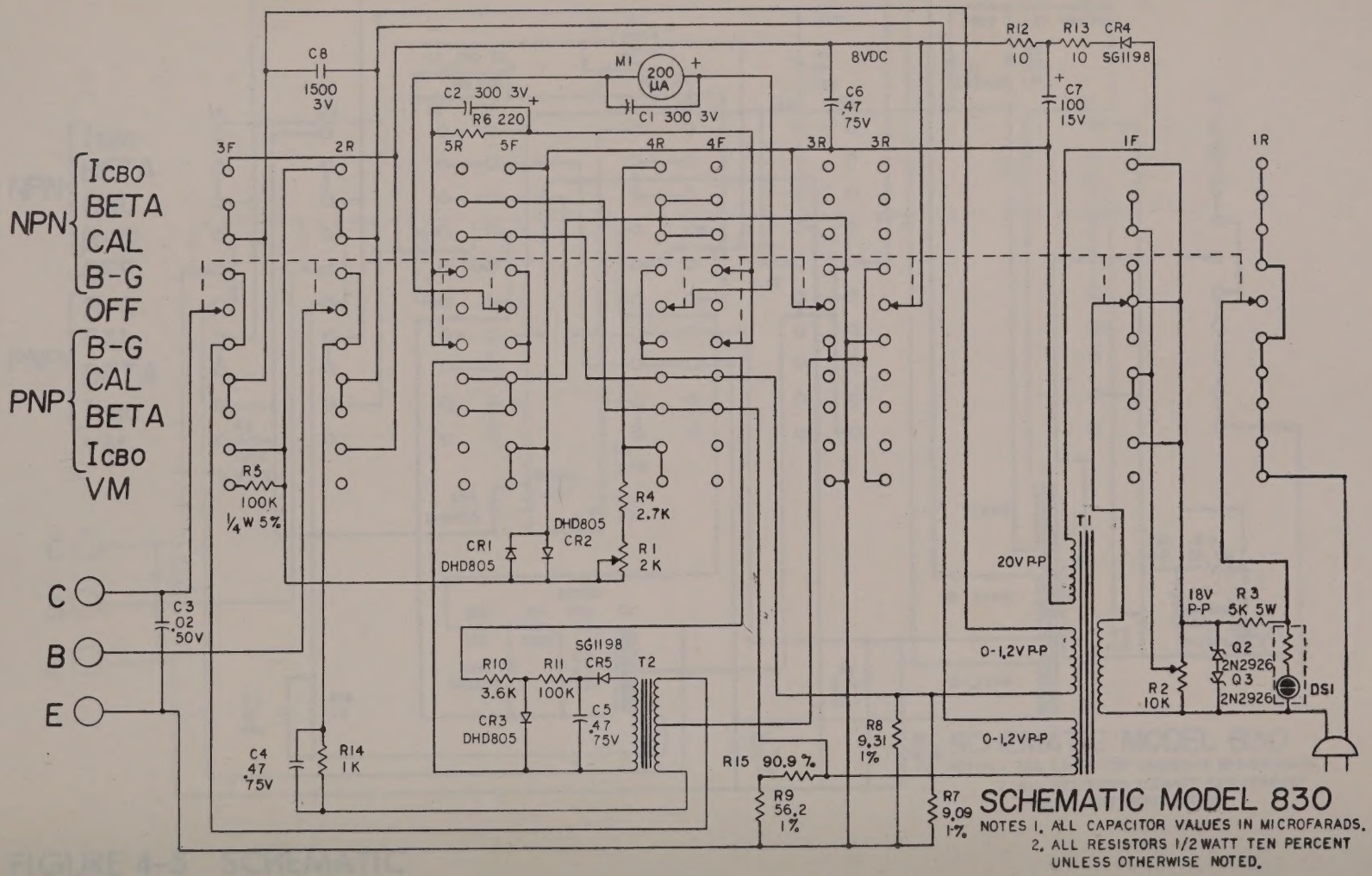












SCHEMATIC MODEL 830

NOTES 1. ALL CAPACITOR VALUES IN MICROFARADS.
2. ALL RESISTORS 1/2 WATT TEN PERCENT UNLESS OTHERWISE NOTED.

FIGURE 4-5 SCHEMATIC

TM

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